

The Oceanography Report



NITTING DEPOSIT.
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U.S. To Aid Coastal Research

Mary Hope Katsouros

Prior to the 1984 implementation of the 1982 Convention on the Continental Shelf, oceanographers were free to plan and carry out research projects virtually anywhere on or under the seas of the world (see Article 5(1) and 5(8)). Today, dozens of coastal nations regulate marine research within 200 nautical miles (370 km) of their shores, imposing increasingly severe restrictions and creating diverse and uncertain research procedure. Both the Reagan administration and Congress have acted recently to alleviate some of these jurisdictional problems being experienced by U.S. marine scientists.

On March 10, 1983, President Reagan issued a proclamation on the "Exclusive Economic Zone of the United States of America" and related statements. It is the accompanying "Statement by the President" and the "Fact Sheet" on "United States Oceans Policy" (all three of which are dated March 10), rather than the proclamation, that outline the U.S. position on the conduct of marine scientific research. The "Statement by the President" declares that,

Thus, the science provisions of the proclamation appear to be forthright. They foster marine scientific research by all in the U.S. EEZ, while recognizing the right of other coastal nations to claim jurisdiction over marine scientific research. The "Statement by the President" declares that,

It is too soon to predict the reaction of other coastal nations to the Reagan proclamation. Some observers feel that there may be a flurry of unilateral claims by other coastal nations directed solely against the United States—a reaction similar to the which greeted the Truman Proclamation. This opinion is based on the selective nature of the proclamation (for instance, its refusal to recognize coastal nations' jurisdiction over tuna).

There are other issues that the marine scientific community needs to consider especially now when the Congress and the Administration have demonstrated their interest and concern regarding the problems facing U.S. marine scientists who want to do research abroad.

The first set of questions to be addressed deal with the President's statement that the U.S. will recognize other coastal jurisdictions only if they are "exercised reasonably in a manner consistent with international law." How will the standards both of "reasonableness" and "consistency with international law" be established? Should requests be forwarded even if the United States does not agree that all the restrictions imposed by a foreign country are consistent with international law? For example, Trinidad and Tobago specify two additional prerequisites for approval of a research project. The first is that research data and results may be published only with the government's consent and, second, that all claims and specimens are the property of Trinidad and Tobago.

If the U.S. considers a nation's policy unreasonable, should a dialogue be initiated in the hope that a foreign state will alter its policies? In this regard, should the Law of the Sea obligations (Article 248 and 249) dealing with marine scientific research be recognized as the upper limits that U.S. marine scientists will accept, and if so, who should monitor whether the obligations have been met? This last point is extremely important because Article 252 of the Law of the Sea provides that a coastal state may withhold consent to research if the research state or international organization has unfulfilled obligations.

Article 105 defines a marine scientific research area as (1) an area the outer boundary of which is the base line from which the territorial sea of the coastal state is measured and the outer boundary of which is a line drawn in such a manner that each point on it is two hundred nautical miles from the inner boundary; and (2) the continental shelf of the coastal state.

In directing the Secretary of State to submit research requests to other countries on behalf of U.S. scientists, Section 105 also directs the Secretary to declare, as part of the request, that the United States recognizes marine scientific research as a freedom of the high seas. However, neither the Policy Statement, the Proclamation, nor the Fact Sheet

indicate that such research is a freedom of the high seas.

The international agreements specified in Section 105 are intended to reduce the financial and procedural burden of obtaining research permission. Furthermore, the legislation states that agreements should be sought with those coastal nations in which U.S. marine scientists have expressed the greatest research interest.

Congressional interest in the issue was previously indicated on January 6, 1983, when Rep. Gerry E. Studds (D-Mass.) introduced H.R. 703 to facilitate the conduct of international marine scientific research. This bill differs from the Presidential proclamation and the implementing legislation because it asserts the right of all coastal countries to regulate, authorize, and conduct marine scientific research on the Outer Continental Shelf and in coastal waters out to 200 nautical miles. It provides, further, that marine research may be conducted by scientists in any area under U.S. jurisdiction, provided that the research is conducted in a lawful manner. Like the later legislation, H.R. 703 also requires the Secretary of State to transmit marine research requests from U.S. scientists to other countries and to initiate negotiations that will facilitate international marine scientific research.

What do these developments mean to marine scientists?

Until the issuance of the proclamation, the United States had been unable to process requests by U.S. scientists to conduct research in waters adjacent to other nations unless a portion of the research as to be conducted within 3 nautical miles (5.5 km) of shore, up to 12 nautical miles (22.25 km) for fisheries research, and, with respect to the shelf research, throughout the coastal state's Outer Continental Shelf. This policy raised hardships for many U.S. marine scientists in recent years because they were forced to alter significantly the scope and cost of their research projects in order to gain Department of State cooperation in forwarding research requests. The new role specified for the Department of State in the proclamation will alleviate this problem (memorandum of March 11, 1983, by William E. Ritter, Director, Office of Marine Science and Technology Affairs, Bureau of Oceans and International Environmental and Scientific Affairs, Department of State).

The second set of issues which need to be examined deal with bilateral and multilateral agreements. The implementing legislation instructs the Secretary of State to initiate negotiations and that agreements should be sought with those coastal states in which U.S. scientists have expressed the greatest interest in conducting marine scientific research. A recent study of U.S. research vessel clearance experience during the period 1972–1978 shows that 25% of U.S. research was conducted by two countries—Mexico and Canada (Wooster, 1981). If bilateral agreements are to be pursued, should they be with our neighbors? What are the incentives for a coastal nation to enter negotiations to facilitate marine scientific research? Who will pay the costs associated with bilateral and multilateral agreements? Will scientists be asked to participate in the negotiations?

The questions raised thus far only indicate the need for marine scientists to continue to emphasize the uncertainties they face. The proclamation eliminates the problem which the Department of State had in forwarding research requests to other countries. This is a significant step forward; however, it does not end all the political constraints facing oceanographers. To ensure the implementation of the proclamation and the implementing legislation, the community must provide its views to the Administration and Congress on procedural issues and on ways in which marine scientific research and international collaboration can be advanced.

Reference

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Information Report

NRC Committees on Oceanography

The dust now is settling from last year's restructuring of the National Research Council (NRC) from seven assemblies and commissions to three commissions, two offices, and an independent board (*Eos*, April 27, 1982, p. 250, and March 16, 1982, p. 194). The individual committees and boards within these six new units now are moving full-speed ahead. This information report reviews four of the new boards that touch on oceanography.

Of the all the shifts made to create these four boards, the biggest overhaul involved merging the old Ocean Sciences Board with the old Ocean Policy Committee to form a new Board on Ocean Science and Policy (BOSP) (*Eos*, May 3, 1983, p. 172).

BOSP, which is within NRC's Commission on Physical Sciences, Mathematics, and Resources, first met on May 4, with former NSF Director John B. Slattery, now chancellor of the University of Maryland, at the helm. One of the main problems facing the board, according to Mary Hope Katsouros, BOSP executive secretary, is the vast array of new satellite technologies available and the current lack of a consensus on which ones will be most useful to oceanographers. In addition, oceanographers will need to address the implications of the U.S. not being party to Law of the Sea for marine scientists. A declining budget

indicates that the coastal state may participate or be represented in the project.

Article 249 comprises two paragraphs enumerating conditions with which the researching state must comply: Paragraph 1 lists the researching state's (or international organization's) obligations, including allowance for coastal state participation or representation, providing preliminary reports and final results, provision for access to or receipt of data and samples, helping (or requesting) the state to assess results, making these results generally available (subject to paragraph 2), informing coastal states of major changes in the project, and returning any installations or equipment after research is completed.

Paragraph 2 declares that the preceding provisions are without prejudice to other conditions established by the coastal state for the granting or withholding of its consent under Article 246(S), including the requirement of prior agreement for making research results available internationally when a project is of direct significance for the exploration and exploitation of natural resources. Although this provision contemplates possible prior restraint on dissemination or research results, it is limited to research related to natural resources, for which consent is a matter of coastal state discretion. Any other conditions, such as requirement of local publications, are also specifically limited to research covered by Article 246(S).

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Books (cont. from p.401)

Robert Edwards discusses the Georges Bank fisheries during the 1962-1977 period, when foreign fishing peaked and then declined as a result of dwindling stocks and tarey restrictions. The total catch remained fairly high at 700,000 tonnes until 1975, but only because of shifts in stock: The silver hake, haddock, cod and saithe peaked early in 1968, the herring in 1968, and the mackerel in 1973. Had some restraint been observed, these stocks might have remained above their minimum spawning size and consequently greatly increased the integrated yield. No restraint was observed, of course, and the stocks were harvested faster than natural spawning could replace them.

However, the activation of the slow feedback loop through the political system began no later than the establishment of the International Convention for the Northwest Atlantic Fisheries (ICNAF). Henry Lyman continues this discussion by summarizing the role of the New England Regional Fishery Management Council on Georges Bank, which was established under the Fishery Conservation and Management Act (FCMA) of 1976. The FCMA has very explicit objectives: to restore overfished stocks, to maintain fisheries resources, to promote unused species, and to allow foreigners to harvest surplus stocks. The council had difficulty gaining sufficient authority and winning popular support among fishermen. In the several years since its implementation, the council can point to a number of successes, most of them linked to the restrictions placed on foreign fleets.

The FCMA is not autonomous, and its interests are often compromised for U.S. foreign policy considerations. For example, Soviet fishing infractions were waived in deference to the SALT negotiations, and the Canadian dialogue over fishing rights was influenced by the Canadian assistance to the U.S. hostages in Iran. Francis Cameron summarizes these problems and the role of international law in providing a workable treaty with the Canadians over the Georges Bank fishery. The problem is twofold: territorial rights and fisheries management. The latter need not wait for the former. Currently, stocks are managed through uncoordinated programs. The objectives and structure of such a treaty are far less an obstacle than is agreement on the catch entitlements for the two nations.

The fisheries community sees a threat in the use of the Georges Bank for oil and gas drilling: Drilling disrupts and endangers fishing, and drill wastes and oil spills pollute the grounds. Whether the drilling is tolerable is another question. Sarah Bates presents some of the legal aspects of oil leasing and concludes that, "Courts simply are not and cannot be the forum in which to debate the wisdom of OCS [Outer Continental Shelf] activity on Georges Bank."

Much of the dichotomy lies in the appraisal of the relative value between nonrenewable and renewable resources. In the one pro-lure lecture, J. R. Jackson, Jr., contends that the possibility of retrieving 21 days' supply of fuel for the U.S. justifies the OCS activity, and, as reassurance against an environmental accident, he cites the industry's safety record. An assessment of the impacts of oil pollution is elusive, since, as Carl Sanderman points out, crude oil contamination of resource species does not appear to cause a definite hazard to human consumers. However, serious, long-term effects on the marine ecosystem are possible but beyond our ability to quantify. The more complicated life forms may be sensitive to environmental stress at one stage but not another, or their behavior may be altered significantly. Karen Pryor reviews the susceptibility of the Georges Bank mammals and birds to oil pollution. Again, because of complicated behavior patterns, the effect on a

community can be more dramatic than that on an individual.

While the threat of oil drilling on Georges Bank has abated, the argument is still very timely. If the human feedback loop is ever to be effective, we must educate ourselves in ecological principles and take remedial action before problems arise, not afterward.

The introductory and final lectures are very appropriate to this theme. Guy McLeod and John Prescott introduce the series through a summary of the Georges Bank's fishery resource and the seemingly inevitable disregard for it by the federal and private oil interests. Warren Johnson closes the series with an eloquent plea for sanity in our use of technology and the appetites that it generates.

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Igneous and Metamorphic Petrology

M. G. Basi, W. H. Freeman, San Francisco, xviii + 630 pp., 1982.

Reviewed by James D. Hoover

So many new and exciting topics in petrology have appeared over the last several years that it has become difficult to find a text that deals adequately with fundamental as well as current topics; the present book may be one of the better texts in this field today because it achieves this combination with clarity and appropriate emphasis. The book provides a comprehensive coverage of descriptive, theoretical, and experimental topics. The relationship between the origin and evolution of igneous and metamorphic rocks and the associated physical and tectonic processes is the unifying theme of the text.

The book is intended as a text for undergraduate geology majors with a background in physical and historical geology and mineralogy. It is divided into four main categories: magmatic rock bodies, magmatic systems, metamorphic bodies and systems, and the early history of the earth and other planetary bodies. The organization of the first three of these sections is intended to be flexible in scope, emphasis, and variety of subject matter. Each chapter is outlined, prefaced with an overview of the section, and summarized in outline form. Key terms appear in bold type, and study questions are provided in interpretive chapters. Breadth and clarity of subject matter is emphasized, and good use is made of figures, tables, and photographs of rocks in the field, in hand specimen, and in thin section. The appendix contains a summary of some petrographic techniques, a review of the physical and optical properties of some rock-forming minerals, and representative chemical analyses of some major rock types.

The introductory chapter includes discussion on methods of investigation, philosophy of classification, and the flow of energy in geologic systems from a thermodynamic point of view. Both the igneous and metamorphic parts of the book follow a common format: first an overview of basic principles, then descriptive and interpretive material combined with discussions on processes and theoretical applications.

The section on igneous rocks begins with an overview on philosophy of classification and the use of the fabric, compositional data, variation diagrams, trace element data, and isotopic data. The section emphasizes the interrelation between tectonism, magmatism, and metamorphism within the framework of plate tectonics. The descriptive part of the igneous section is organized into chapters on calc-alkaline volcanic rocks, calc-alkaline plutonic rocks, subalkaline basaltic and ultramafic rocks, and alkaline rocks. Each of these chapters contains excellent descriptions of field relationships, mineralogy, and fabric discussed also in terms of the physical and chemical properties of magmas. The sections on calc-alkaline rocks includes discussions on volcanic features and eruptive sequences and the origin of granitic magmas. Layered intrusions, mid-ocean ridge basalts, and ophiolites are among the topics discussed in the section on subalkaline basaltic rocks. Tholeiitic-alkaline transitions and the characteristics of strongly alkaline rocks, kimberlites, and carbonatites are among the topics discussed in the section on alkaline rocks, together with an overview of concepts bearing on their origin.

The second part of the igneous section contains a survey of phase equilibria, the compositional and kinetic aspects of magmas, petrogenetic processes for the generation, differentiation, and ascent of magmas, and the role of tectonic forces in controlling them. Included in this section are discussions on silicate melt structures, diffusion, nucleation and crystallization in silicate systems, and an overview of concepts such as thermogravitational diffusion, double diffusion processes, and the physical aspects of magma emplacement.

The five chapters of metamorphic rocks deal with fabrics, compositions, field relations, and the associated physical and chemical processes of metamorphic rocks.

The introductory section is outstanding in its summary of fundamentals such as classification, recrystallization processes, and the concepts of metamorphic grade, zones,

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Reviewed by James D. Hoover

treatment of certain topics. Topics on petrogenesis are interspersed in descriptive sections to stimulate interest but often seem out of place without the aid of concepts explained in later chapters. Some topics, such as evolution and evolution of the mantle seem misplaced, and the treatment of other topics, such as trace element and isotopic applications, seem incomplete. For example, the behavior of useful trace elements (e.g., the REE) and the evolution of such data is not well illustrated, nor is there reference to lead or hydrogen isotope studies. It is also notable that discussion of the Hawaiian volcanic sequence warrants only one paragraph in a chapter on alkaline rocks. Little mention is made of geochemistry or geobarometry in either the igneous or the metamorphic sections. Few quantitative examples of thermodynamic applications are presented up to the phase rule. Examples of metamorphic reactions, thermodynamic principles, kinetics, and metamorphic differentiation are also presented in the process-related sections.

The last two chapters in the book deal with the early history of the earth and other planetary bodies. Among the topics covered are Archean and Proterozoic terrains, the chemical evolution of the mantle, crust-mantle differentiation, and core segregation. These drawbacks, however, are minor in the context of the entire presentation. As an introductory text, the book is very good. Because of its scope, the book may also be useful as a general reference to the many topics in hard rock petrology and acronyms of the earth and other planetary bodies.

Overall, the book is a remarkable compilation of classical and current concepts in the importance of intelligent gathering and evaluation of facts is stressed. The most positive aspects of the text are the scope and generally thorough level of treatment of subject matter, and style of presentation. Various types of petrologic data are presented to the reader, and the salient features summarized. Relevant problems are also pointed out, and alternate explanations or models are proposed. Moreover, the author lucidly blends current research and ideas into the discussions.

The book has drawbacks, however, in certain aspects of its organization and in its treatment of certain topics. Topics on petrogenesis are interspersed in descriptive sections to stimulate interest but often seem out of place without the aid of concepts explained in later chapters. Some topics, such as evolution and evolution of the mantle seem misplaced, and the treatment of other topics, such as trace element and isotopic applications, seem incomplete. For example, the behavior of useful trace elements (e.g., the REE) and the evolution of such data is not well illustrated, nor is there reference to lead or hydrogen isotope studies. It is also notable that discussion of the Hawaiian volcanic sequence warrants only one paragraph in a chapter on alkaline rocks. Little mention is made of geochemistry or geobarometry in either the igneous or the metamorphic sections. Few quantitative examples of thermodynamic applications are presented up to the phase rule. Examples of metamorphic reactions, thermodynamic principles, kinetics, and metamorphic differentiation are also presented in the process-related sections.

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representation of certain topics. Topics on petrogenesis are interspersed in descriptive sections to stimulate interest but often seem out of place without the aid of concepts explained in later chapters. Some topics, such as evolution and evolution of the mantle seem misplaced, and the treatment of other topics, such as trace element and isotopic applications, seem incomplete. For example, the behavior of useful trace elements (e.g., the REE) and the evolution of such data is not well illustrated, nor is there reference to lead or hydrogen isotope studies. It is also notable that discussion of the Hawaiian volcanic sequence warrants only one paragraph in a chapter on alkaline rocks. Little mention is made of geochemistry or geobarometry in either the igneous or the metamorphic sections. Few quantitative examples of thermodynamic applications are presented up to the phase rule. Examples of metamorphic reactions, thermodynamic principles, kinetics, and metamorphic differentiation are also presented in the process-related sections.

The last two chapters in the book deal with the early history of the earth and other planetary bodies. Among the topics covered are Archean and Proterozoic terrains, the chemical evolution of the mantle, crust-mantle differentiation, and core segregation. These drawbacks, however, are minor in the context of the entire presentation. As an introductory text, the book is very good. Because of its scope, the book may also be useful as a general reference to the many topics in hard rock petrology and acronyms of the earth and other planetary bodies.

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